Turk J Kin 2015; 1(1): 15-19
www.turkishkinesiology.com Original Research

Effects of land versus water based fitness program in improving aerobic fitness, muscular strength and speed among young male beginner soccer players

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Abstract. The primary purpose of this study was to evaluate the effects of land versus water based fitness program in improving aerobic fitness, muscular strength and speed among Young Male Beginner Soccer Players. Twenty-four young male beginner soccer players from Mugher district were selected as subjects. Their ages were 14-17years. The subjects were randomly assigned to land based performing exercise group (LEG, 12 male) and water based performing exercise group (WEG, 12 male). They participated in land based and water based exercises (both deep and shallow water) training for 3 months, 3 days per week for 50 minutes. The fitness variables selected for the study were aerobic fitness, muscular strength, and speed. After 12 weeks of training, the WEG improved better in soccer types of physical fitness qualities. In aerobic fitness the WEG increase by 21% (600 yard run/walk 22% and 12 min run/walk 20%) and the LEG increased by 13% (600 yard run/walk 18% and 12 min run/walk 8%). Speed increased more by WEG as compare to LEG group. In 40-yard performance WEG showed 12% incremental change, while the LEG improved by 11%. In addition, 9% increment was observed in WEG and 7% improvement by the LEG was recorded in 60-meter speed performance. Muscle strength was highly enhanced in the WEG. I n barbell squat test, the WEG and LEG have shown 46% and 29% changes, respectively. These results indicated that long-term water based performing exercises were better than the land based performing exercises in improving aerobic fitness, muscular strength and speed of beginner soccer players.

Keywords. Aerobic fitness, land based exercise, speed, strength, water based exercise.

Introduction

Soccer was a multifaceted sport that requires well-developed physical fitness to be successfully played (Stolen et al., 2005). Physical fitness in soccer is the physiological and functional status of the players that allows them to play the game effectively, resist fatigue and enhance global quality of life (Mohr et al., 2003). Fitness has Components such as muscular strength, muscular endurance, power, speed, cardiovascular endurance, flexibility, agility and coordination.

Water fitness activity is an exercise that is performed in the water, which promotes and enhances physical and mental fitness. Water fitness is among the most popular and widely prescribed fitness activities because it appears to be suitable for different groups: older, injured, and even healthy people (Benelli et al., 2004). Water exercise programs had an enormous benefit in the improvement of physical fitness and are attributes for each physical fitness components (Barbosa et al., 2009). The density of water is approximately 800 times that of air, this has an important contribution to the energy cost of water exercise (Prampero, 1986).

In the water, the body is buoyant and the impact to the joints during exercise is significantly less than on land. Buoyancy creates a reduced impact exercise alternative that is easy on the joints, while the water's resistance challenges the muscles (AEA, 2011). The dual effect of buoyancy and resistance creates an environment that requires high level of energy expenditure with relatively little movement or strain on low joints extremities. Generally, Water exercise elicits significant improvements in cardio respiratory fitness, muscular strength, body fat and total cholesterol and appears to be safe and beneficial mode of exercise that can be performed as a part of well-rounded exercise (Takeshima et al., 2002).

Land-based fitness programs are those exercises which are performed as indoor and outdoor (on the ground) physical activities. They can refer to physical activities that carried various aerobic and anaerobic exercises. Both aerobic and anaerobic exercises are the most important to any workout and are the basis for a healthy lifestyle (http://www.fitness). Developing good conditioning programs based on the specific physiological demands of each sport is considered as a key factor (Balcilunas et al., 2006). Actually both land and water based fitness programs have

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an effect on improvement of aerobic fitness, muscular strength and speed, but no one is exactly sure whether land or water based performing exercise is better in bringing improvements. So this research was conducted to fill this gap. It is an interesting topic for physical exercise scientists, coaches, athletes, exercise physiologist and other specialists in sports and exercise science. Therefore, the following points were answered in this experiment: What is the effect of land-based exercise and water-based exercise on enhancing muscular strength, speed and aerobic fitness of beginner soccer players? Does land-based exercise and water-based exercise have significant effect on improving these physical fitness qualities after three months of continue training program?

The aim of this study was to evaluate the effects of land versus water based fitness program in improving aerobic fitness, muscular strength and speed among young Male beginner soccer players.

Materials and methods

This research was conducted at Mugher Cement Enterprise camp which is located in the Oromia regional state, at West Shewa zone in Adeaberga Werada in North West direction at about 95 Km away from Addis Ababa. Geographically located at 10° , 46′ North, and 37° , 4′ East at 2545 m above sea level (www.mu.gov.et). All the tests and physical activity trainings were conducted at the Enterprise's swimming pool, gymnasium and stadium. This study was conducted for three months during preparatory period of Mugher youth soccer project training program; beginning from November 2013 to January 2014.

This research has been conducted as pre-rules, policies and research ethics of Haramaya University. The Haramaya University College of Health and Medical Science was approved the protocol. Permission was obtained from Enterprise and sport club. The signed consent was provided to participant earlier with a written letter.

Subjects

The source of population for this study was youths of Mugher soccer player; who was the member of Mugher youth soccer project team. Male and healthy soccer players of Mugher youth soccer project who had a normal body mass index (19±0.6) with the age ranging from 14 to 17 were the subjects of the study.

First Permission was obtained from manager of sport club then twenty-eight volunteer player filled the medical history questionnaire, which was prepared with the aim of identifying whether they are free from cancer, heart disease, stroke and kidney problems. Since four of the twenty-eight players were rejected due to the factors mentioned above, the study was conducted with the remaining twenty-four male subjects.

Study design

Complete randomize design was used for this study. The research was conducted with young male soccer players with the age of 14-17years old from Mugher district. Beside this, the research focused on field study of twelve-week fitness program including land and water based performing exercise. The selected subject took part in to two groups; LEG and WEG. Both groups were involved in training program for 12 weeks, 3days per a week for 50 minutes. In addition to this, tests were administered for the selected subject on a selected physical fitness (aerobic fitness, muscular strength and speed) at pre, during, and post training.

Inclusion and exclusion criteria

Good at basic sport skills, being free from chronic disease, having skill of swimming, normal range of BMI, healthy body and being free from any drug abuse were the criteria's that were needed to be fulfilled to be the subject of this study. In contrast to this the players, who had special training programs were excluded from this study. Additionally, according to their health history questionnaire result, participants who had medical condition restriction and recent injury status were excluded from this study.

Data collection

Double experimental measurement was used to measure each dependent variable of this study (aerobic fitness, muscular strength and speed). Primary data was gathered from the subjects by three phases with 6 weeks gap as pretest (PT), middle test (DT) and posttest (PoT). This data was collected from the subjects through structured programs. Data was collected at the same time of the day to control biological factors and between subject's variations (Reily & Brooks, 1982) with the following physical fitness tests, 600 yard run /walks Test, 60-Meter Speed, Barbell Squat and Standing Long Jump.

Exercise training protocol

The selected subject was randomly divided in two groups. Both groups were engage in conditional exercises for two weeks. In the third week, WEG began water-based fitness training program and the LEG continued in land based fitness training program. Both kinds of training programs consist; aerobic fitness, speed, and muscular strength exercises which have similarity in their nature such as mini football, swimming, 15 meter sprinting, sit up and abdominal crunches.

The duration of exercise was 50 minutes with the frequency of three days per week. This includes 10 minute of warm up and stretching, 35 minute of main activity, 5 minute of cool dawn and stretching. All exercises were conducted on Mugher Cement Enterprise swimming pool, which has 13 x 25m shallow water (0.5 to 1 meter depth) and 27 x 25m deep water (2-3m depth) and in stadium.

Data quality control

The researcher collected the data with the help of one assistant (diploma holder). To avoid errors, training has been given for the assistance data collector on how to use data collecting instruments and measurements during data collection. Only standardized materials were used to keep the quality of the data. Additionally, all the aforementioned tests were recorded with video and photograph. Finally, the data had been coded and feed to software twice, with different persons to avoid error in data feeding.

Data analysis

The data analysis was done by SPSS statistical software package Version 19.0. After collecting the data on speed, muscular strength and aerobic fitness from both groups it was analyzed with Paired sample t-test. The level of statistical significance was set at $P<0.05$.

Results and discussion

This chapter deals with the analysis of data collected from the samples under this study. In this study, field tests had been taken three times (Pre, during and post). Under this, three dependent variables (Aerobic fitness, muscle strength and speed) were evaluated by 600 yard running/walking, 12 minute running/walking, 40-yard dash, 60-meter speed, barbell squat test and standing long jump. The results of those variables are discussed as follows.

Effect of land based and water based fitness program on aerobic fitness performance

Significant difference was observed on both land based exercise group (LEG) and water based exercise group (WEG), when we compare their pre and post mean values of both groups. The reason was due to aerobic fitness trainings given to them. More improvement was observed on water based exercise group as compare to land based exercise group.

The above table showed 600 yard running/walking (SHYR), and 12 minutes running/ walking (TMR) in both Land-based exercise group and Water-based exercise group. The mean value of LEG in SHYR was decreased from 138.2 to 112.8sec., with -25.4 mean differences and WEG was decreased from 136.5 to 106.7sec., with -29.8 mean differences. The mean difference revealed that there was an improvement on aerobic fitness of both groups. This was due to the cardiovascular endurance training they were engaged in.

The negative mean value difference in both groups on 600 yard running/walking, which indicates the performance enhancement, as the time to finish distance decreased. 18% improvement was recorded in 600 yard running/walking and land-based exercise group observed 8% of development in 12 minute running/walking. However, by water-based exercise group 22% improvement was recorded in 600 yard running/walking and 20% of development is observed in 12 minute running/walking. On average WEG increased aerobic fitness by 8% greater than LEG.

The study is compatible with Piero et al. (2004) finding, which entitled ''Comparison Between Land-Based and Water Aerobics Exercise on Young Healthy women''. The study assured as water based performing exercises increase Vo_2 max by 21% and decrease exercise heart rate by 7%. A similar result was observed in a research conducted by Heithold & Stephen (2002). They could observe significantly higher HR on land exercise (126 ± 12.23 to 141.5 ± 13.7 beats/min) compared to water exercise (105 ± 5.72 to 112.21 ± 10.55 beats/min).

Pohl & Naughton's results are consistent with outcome of this study. They compare the physiological response of walking/ running on land treadmill and water treadmill at two different depths. Vo_2 max of water treadmill was elevated more than running on land treadmill and the remaining variable showed reduction, which indicated the improvement of aerobic fitness (Pohl & Naughton, 2003). Dowzer et al. (1999) obtained similar result to this finding. They pointed out peak VO_2 during SWR and DWR was an average of 83.7%, and the land treadmill running was 75.3.

Table 1. Mean value of 600 yard running/walking (sec.) and 12 minute running /walking (m) performance for LEG and WEG.

	LEG			WEG		
	PT	DT	PoT	PT	DT	PoT
SHYR (sec)	138.2±6.2	121.8 ± 3.53	112.8 ± 3.59	136.5 ± 4.99	118.9 ± 3.6	106.7 ± 2.4
TMR (m)	2420.8±24.96	2483.3 ± 27.06	2629.2 ± 32.25	2387.5 ± 40.88	2641 ± 48.39	2870.8 ± 43.71

Effect of land based and water based fitness program on speed

Significant improvement of speed performance was recorded in both groups. Mean value of LEG in forty yard dash (FYD) and 60 meter speed (SMS) was decreased from 5.7 to 5.1 sec. with -0.6 mean difference and 8.8 to 8.2 sec. with -0.6 mean differences respectively. On the other hand, WEG was registered 5.7 to 5.0 sec. with -0.7 mean differences and 8.7 to 7.9 sec. with -0.8 mean difference respectively for FRD and SMS. With this regard the negative mean difference value showed that, the time to cover a given distance has been decreased. On the other hand it indicates the improvement of speed performance.

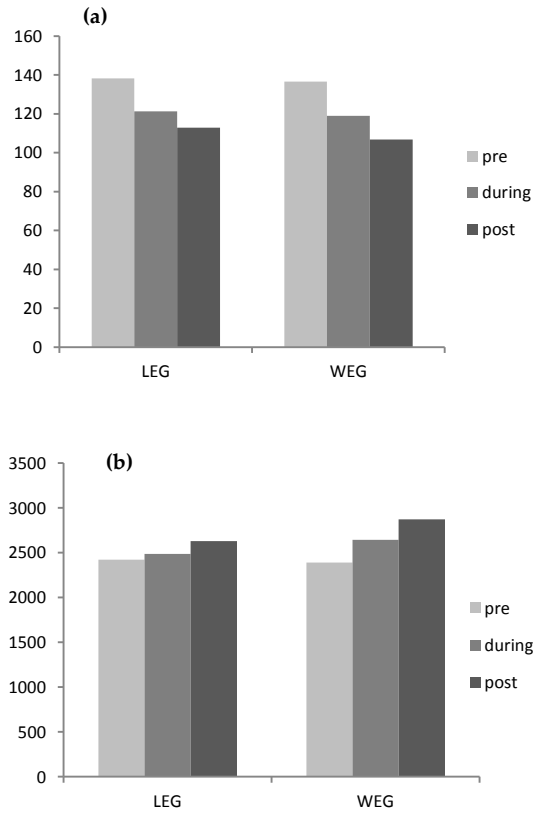

Figure 1. 600 yard running/walking (a) and 12 minute running /walking (b) PT, DT and PoT mean results of LEG and WEG.

The LEG decreases the sprinting time by 11% for FYD and 7% for SMS, while the WEG decreases the sprinting time by 12% and 9% for FYD and SMS respectively. Generally, the LEG increased their speed or sprinting performance by 8.5% while the WEG improved their speed by 10.5%. This average value indicates that WEG greatly improved their speed by 2.5% over LEG.

Effect of land based and water based fitness program on muscular strength

The mean analyses result revealed the significant improvement on muscular strength on both groups. There were significant difference between PT, DT and PoT mean value of land-based exercise group. This group showed 18% improvement from PT –DT and 29% improvement from PT-PoT in barbell squat, whereas water-based exercise group was recorded 29% improvement from PT-DT and 46% improvement from PT -PoT in barbell Squat.

Generally, when LEG achieved an average of 29% muscular strength, the WEG gained an average of 46% of muscular strength. The water based exercise group increased their strength by 17% greater than land based exercise group. The rationale behind the strength improvement was due to 12 weeks strength training they engaged in swimming pool and at Mugher stadium. This result is supported with the finding of Colado et al. (2009), Bento et al. (2012), Hertler et al. (1992), and Hoeger et al. (1993).

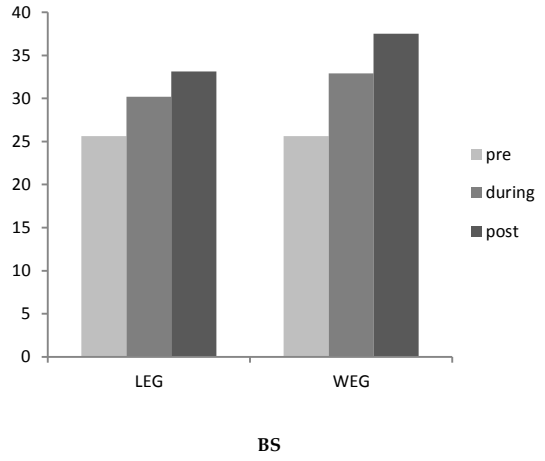

Figure 2. Barbell squat PT, DT PoT mean results of LEG and WEG

Conclusions

Based on the major findings of the study, the following points are stated as a conclusion

- As proved from this study the land based performing and water based performing exercise programs significantly improve aerobic fitness, speed and muscular strength of soccer players.
- Due to the dual effect of buoyancy and water resistance, water based performing exercise is much better to improve aerobic fitness, speed and muscular strength of soccer players than land based performing exercise program.

The findings of this research provide that a 12 weeks' land and water based fitness programs significantly altered

a selected physical fitness variable of the participants. Based on these results, discussions and findings of the research, the following recommendations are made.

- Considering the benefits of water-based exercise, coaches of soccer players should include such kind of exercise in their training programs
- Efforts should be taken to popularize the benefits of water based fitness program for soccer kind of fitness quality, which in turn make the nation to produce fit soccer player.
- Related to water-based fitness program the future research shall focus on match related soccer performance, training phase, and the possible benefits of water based fitness programs in any other sports like athletics, volleyball, basketball, etc and their possible side effects.

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